



## PPM-X syndrome

PPM-X syndrome is a condition characterized by psychotic disorders (most commonly bipolar disorder), a pattern of movement abnormalities known as parkinsonism, and mild to severe intellectual disability. Other symptoms include increased muscle tone and exaggerated reflexes. Affected males may have enlarged testes (macro-orchidism). Not all affected individuals have all these symptoms, but most have intellectual disability. Males with this condition are typically more severely affected than females, who usually have only mild intellectual disability.

### Frequency

The prevalence of PPM-X syndrome is unknown.

### Genetic Changes

Mutations in the *MECP2* gene cause PPM-X syndrome. The *MECP2* gene provides instructions for making a protein called MeCP2 that is critical for normal brain function. Researchers believe that this protein has several functions, including regulating other genes in the brain by switching them off when they are not needed. The MeCP2 protein likely plays a role in maintaining connections (synapses) between nerve cells. The MeCP2 protein may also control the production of different versions of certain proteins in nerve cells. Although mutations in the *MECP2* gene disrupt the normal function of nerve cells, it is unclear how these mutations lead to the signs and symptoms of PPM-X syndrome.

Some *MECP2* gene mutations that cause PPM-X syndrome disrupt attachment (binding) of the MeCP2 protein to DNA, and other mutations alter the 3-dimensional shape of the protein. These mutations lead to the production of a MeCP2 protein that cannot properly interact with DNA or other proteins and so cannot control the expression of genes. It is unclear how *MECP2* gene mutations lead to the signs and symptoms of PPM-X syndrome, but misregulation of genes in the brain likely plays a role.

### Inheritance Pattern

More than 99 percent of PPM-X syndrome cases occur in people with no history of the disorder in their family. Many of these cases result from new mutations in the *MECP2* gene.

A few families with more than one affected family member have been described. These cases helped researchers determine that PPM-X syndrome has an X-linked pattern of inheritance. A condition is considered X-linked if the mutated gene that causes the

disorder is located on the X chromosome, one of the two sex chromosomes. One copy of the altered gene in each cell is sufficient to cause the condition, although females with one altered copy of the gene are usually less severely affected than males.

## **Other Names for This Condition**

- PPMX

## **Diagnosis & Management**

### Genetic Testing

- Genetic Testing Registry: Rett syndrome  
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C0035372/>

### Other Diagnosis and Management Resources

- GeneReview: MECP2-Related Disorders  
<https://www.ncbi.nlm.nih.gov/books/NBK1497>

### General Information from MedlinePlus

- Diagnostic Tests  
<https://medlineplus.gov/diagnostictests.html>
- Drug Therapy  
<https://medlineplus.gov/drugtherapy.html>
- Genetic Counseling  
<https://medlineplus.gov/geneticcounseling.html>
- Palliative Care  
<https://medlineplus.gov/palliativecare.html>
- Surgery and Rehabilitation  
<https://medlineplus.gov/surgeryandrehabilitation.html>

## **Additional Information & Resources**

### MedlinePlus

- Health Topic: Bipolar Disorder  
<https://medlineplus.gov/bipolardisorder.html>
- Health Topic: Developmental Disabilities  
<https://medlineplus.gov/developmentaldisabilities.html>
- Health Topic: Movement Disorders  
<https://medlineplus.gov/movementdisorders.html>
- Health Topic: Psychotic Disorders  
<https://medlineplus.gov/psychoticdisorders.html>

### Genetic and Rare Diseases Information Center

- PPM-X syndrome  
<https://rarediseases.info.nih.gov/diseases/3506/ppm-x-syndrome>

### Additional NIH Resources

- National Institute of Mental Health: Bipolar Disorder  
<https://www.nimh.nih.gov/health/topics/bipolar-disorder/index.shtml>

### Educational Resources

- Centers for Disease Control and Prevention: Intellectual Disability  
[https://www.cdc.gov/ncbddd/actearly/pdf/parents\\_pdfs/IntellectualDisability.pdf](https://www.cdc.gov/ncbddd/actearly/pdf/parents_pdfs/IntellectualDisability.pdf)
- MalaCards: ppm-x syndrome  
[http://www.malacards.org/card/ppm\\_x\\_syndrome](http://www.malacards.org/card/ppm_x_syndrome)
- Orphanet: X-linked intellectual disability-psychosis-macroorchidism syndrome  
[http://www.orpha.net/consor/cgi-bin/OC\\_Exp.php?Lng=EN&Expert=3077](http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=3077)
- TeensHealth from Nemours: Bipolar Disorder  
<http://kidshealth.org/en/teens/bipolar.html>
- University of Kansas Medical Center Resource List: Developmental Delay/ Mental Retardation  
<http://www.kumc.edu/gec/support/devdelay.html>

### Patient Support and Advocacy Resources

- National Parkinson Foundation: Can You Have Parkinsonism Without Having PD?  
<http://www.parkinson.org/understanding-parkinsons/diagnosis/Can-you-have-Parkinsonism-without-having-PD>

### GeneReviews

- MECP2-Related Disorders  
<https://www.ncbi.nlm.nih.gov/books/NBK1497>

### ClinicalTrials.gov

- ClinicalTrials.gov  
<https://clinicaltrials.gov/ct2/results?cond=%22PPM-X+syndrome%22+OR+%22Mental+Retardation%2C+X-Linked%22>

### Scientific Articles on PubMed

- PubMed  
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28ppm-x+syndrome%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+3600+days%22%5Bdp%5D>

## OMIM

- MENTAL RETARDATION, X-LINKED, SYNDROMIC 13  
<http://omim.org/entry/300055>

### **Sources for This Summary**

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